



## TFT LCD Tentative Specification

# MODEL NO.: V370H3 – L02

|             |                                              |                          |
|-------------|----------------------------------------------|--------------------------|
| Approved By | TVHD                                         |                          |
|             | LY Chen                                      |                          |
| Reviewed By | QA Dept.                                     | Product Development Div. |
|             | Kc-Ko                                        | WT Lin                   |
| Prepared By | LCD TV Marketing and Product Management Div. |                          |
|             | WY Li                                        | Chloe Chen               |



## - CONTENTS -

|                                                           |    |
|-----------------------------------------------------------|----|
| REVISION HISTORY                                          | 3  |
| 1. GENERAL DESCRIPTION                                    | 4  |
| 1.1 OVERVIEW                                              |    |
| 1.2 FEATURES                                              |    |
| 1.3 APPLICATION                                           |    |
| 1.4 GENERAL SPECIFICATIONS                                |    |
| 1.5 MECHANICAL SPECIFICATIONS                             |    |
| 2. ABSOLUTE MAXIMUM RATINGS                               | 5  |
| 2.1 ABSOLUTE RATINGS OF ENVIRONMENT                       |    |
| 2.2 PACKAGE STORAGE                                       |    |
| 2.3 ELECTRICAL ABSOLUTE RATINGS                           |    |
| 2.3.1 TFT LCD MODULE                                      |    |
| 2.3.2 BACKLIGHT UNIT                                      |    |
| 3. ELECTRICAL CHARACTERISTICS                             | 7  |
| 3.1 TFT LCD MODULE                                        |    |
| 3.2 BACKLIGHT UNIT                                        |    |
| 3.2.1 CCFL(Cold Cathode Fluorescent Lamp) CHARACTERISTICS |    |
| 3.2.2 INVERTER CHARACTERISTICS                            |    |
| 3.2.3 INVERTER INTERFACE CHARACTERISTICS                  |    |
| 4. BLOCK DIAGRAM                                          | 13 |
| 4.1 TFT LCD MODULE                                        |    |
| 5. INTERFACE PIN CONNECTION                               | 14 |
| 5.1 TFT LCD MODULE                                        |    |
| 5.2 BACKLIGHT UNIT                                        |    |
| 5.3 INVERTER UNIT                                         |    |
| 5.4 BLOCK DIAGRAM OF INTERFACE                            |    |
| 5.5 LVDS INTERFACE                                        |    |
| 5.6 COLOR DATA INPUT ASSIGNMENT                           |    |
| 6. INTERFACE TIMING                                       | 23 |
| 6.1 INPUT SIGNAL TIMING SPECIFICATIONS                    |    |
| 6.2 POWER ON/OFF SEQUENCE                                 |    |
| 7. OPTICAL CHARACTERISTICS                                | 26 |
| 7.1 TEST CONDITIONS                                       |    |
| 7.2 OPTICAL SPECIFICATIONS                                |    |
| 8. DEFINITION OF LABELS                                   | 30 |
| 8.1 CMO MODULE LABEL                                      |    |
| 9. PACKAGING                                              | 32 |
| 9.1 PACKING SPECIFICATIONS                                |    |
| 9.2 PACKING METHOD                                        |    |
| 10. PRECAUTIONS                                           | 34 |
| 10.1 ASSEMBLY AND HANDLING PRECAUTIONS                    |    |
| 10.2 SAFETY PRECAUTIONS                                   |    |
| 10.3 SAFETY STANDARDS                                     |    |
| 11. MECHANICAL CHARACTERISTICS                            | 35 |

**REVISION HISTORY**

| Version  | Date        | Page<br>(New) | Section | Description                               |
|----------|-------------|---------------|---------|-------------------------------------------|
| Ver 1.0  | Feb. 12,'09 | All           | All     | Tentative Specification was first issued. |
| Ver. 1.1 | Mar. 16,'09 | 4             | 1.1     | Update the description about inverter.    |
|          |             | 35            | 11      | Update mechanical drawing                 |

## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

V370H3 - L02 is a 37" TFT Liquid Crystal Display module with 10-CCFL Backlight unit and 2ch-LVDS interface. This module supports 1920 x 1080 FHD format and can display true 16.7M colors (8-bit colors).

The inverter module for backlight is built-in.

### 1.2 FEATURES

- High brightness (450 nits)
- Ultra-high contrast ratio (5000:1)
- Faster response time (Gray to gray average 6.5ms)
- High color saturation NTSC 72%
- Ultra wide viewing angle : 176(H)/176(V) (CR>20) with Super MVA technology
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface
- Color reproduction (nature color)
- Optimized response time for 60 Hz Frame rate
- Low color shift function
- RoHS compliance

### 1.3 APPLICATION

- TFT LCD TVs
- Multi-Media Display

### 1.4 GENERAL SPECIFICATIONS

| Item                    | Specification                                    | Unit  | Note |
|-------------------------|--------------------------------------------------|-------|------|
| Active Area             | 819.36(H) x 460.89 (V) (37" diagonal)            | mm    | (1)  |
| Bezel Opening Area      | 828.6 (H) x 469.8 (V)                            | mm    |      |
| Driver Element          | a-si TFT active matrix                           | -     |      |
| Pixel Number            | 1920 x R.G.B. x 1080                             | pixel |      |
| Pixel Pitch (Sub Pixel) | 0.2(H) x 0.6 (V)                                 | mm    |      |
| Pixel Arrangement       | RGB vertical stripe                              | -     |      |
| Display Colors          | 16.7M                                            | color |      |
| Display Operation Mode  | Transmissive mode / Normally black               | -     |      |
| Surface Treatment       | Anti-Glare coating (Haze 11%), Hard coating (3H) | -     |      |

### 1.5 MECHANICAL SPECIFICATIONS

| Item        |               | Min. | Typ.  | Max.  | Unit | Note         |
|-------------|---------------|------|-------|-------|------|--------------|
| Module Size | Horizontal(H) | 876  | 877   | 878   | mm   | (1)          |
|             | Vertical(V)   | 516  | 516.8 | 517.6 | mm   | (1)          |
|             | Depth(D)      | 35.4 | 36.4  | 37.4  | mm   | To TOP Side  |
|             | Depth(D)      | 50.4 | 51.4  | 52.4  | mm   | To PCB Cover |
|             | Depth(D)      | 55   | 53    | 54    | mm   | To Inv Cover |
| Weight      |               | -    | 7865  | -     | g    |              |

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

| Item                          | Symbol           | Value |      | Unit | Note     |
|-------------------------------|------------------|-------|------|------|----------|
|                               |                  | Min.  | Max. |      |          |
| Storage Temperature           | T <sub>ST</sub>  | -20   | +60  | °C   | (1)      |
| Operating Ambient Temperature | T <sub>OP</sub>  | 0     | +50  | °C   | (1), (2) |
| Shock (Non-Operating)         | S <sub>NOP</sub> | -     | 50   | G    | (3), (5) |
| Vibration (Non-Operating)     | V <sub>NOP</sub> | -     | 1.0  | G    | (4), (5) |

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. ( $T_a \leq 40$  °C).

(b) Wet-bulb temperature should be 39 °C Max. ( $T_a > 40$  °C).

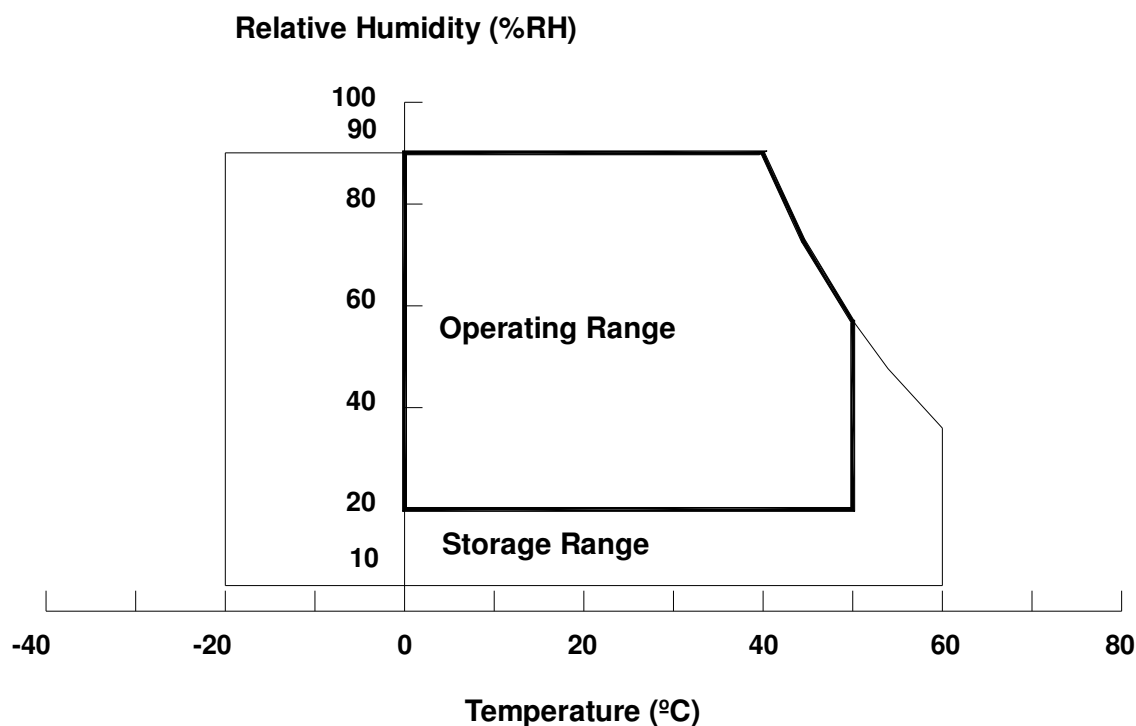
(c) No condensation.

Note (2) The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 65 °C with LCD module alone in a temperature controlled chamber. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 65 °C. The range of operating temperature may degrade in case of improper thermal management in final product design.

Note (3) 11 ms, half sine wave, 1 time for  $\pm X$ ,  $\pm Y$ ,  $\pm Z$ .

Note (4) 10 ~ 200 Hz, 10 min, 1 time each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.





## 2.2 PACKAGE STORAGE

When storing modules as spares for a long time, the following precaution is necessary.

- (a) Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35 °C at normal humidity without condensation.
- (b) The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.

## 2.3 ELECTRICAL ABSOLUTE RATINGS

### 2.3.1 TFT LCD MODULE

| Item                 | Symbol          | Value |      | Unit | Note |
|----------------------|-----------------|-------|------|------|------|
|                      |                 | Min.  | Max. |      |      |
| Power Supply Voltage | V <sub>CC</sub> | -0.3  | 13.5 | V    | (1)  |
| Input Signal Voltage | V <sub>IN</sub> | -0.3  | 3.6  | V    |      |

### 2.3.2 BACKLIGHT UNIT

| Item                 | Symbol          | Test Condition | Min. | Type | Max. | Unit             | Note     |
|----------------------|-----------------|----------------|------|------|------|------------------|----------|
| Lamp Voltage         | V <sub>W</sub>  | Ta = 25 °C     | —    | —    | 3000 | V <sub>RMS</sub> |          |
| Power Supply Voltage | V <sub>BL</sub> | —              | 0    | —    | 30   | V                | (1)      |
| Control Signal Level | —               | —              | -0.3 | —    | 7    | V                | (1), (3) |

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Functional operation should be restricted to the conditions described under normal operating conditions.

Note (2) No moisture condensation or freezing.

Note (3) The control signals include On/Off Control, Internal PWM Control, External PWM Control..

### 3. ELECTRICAL CHARACTERISTICS

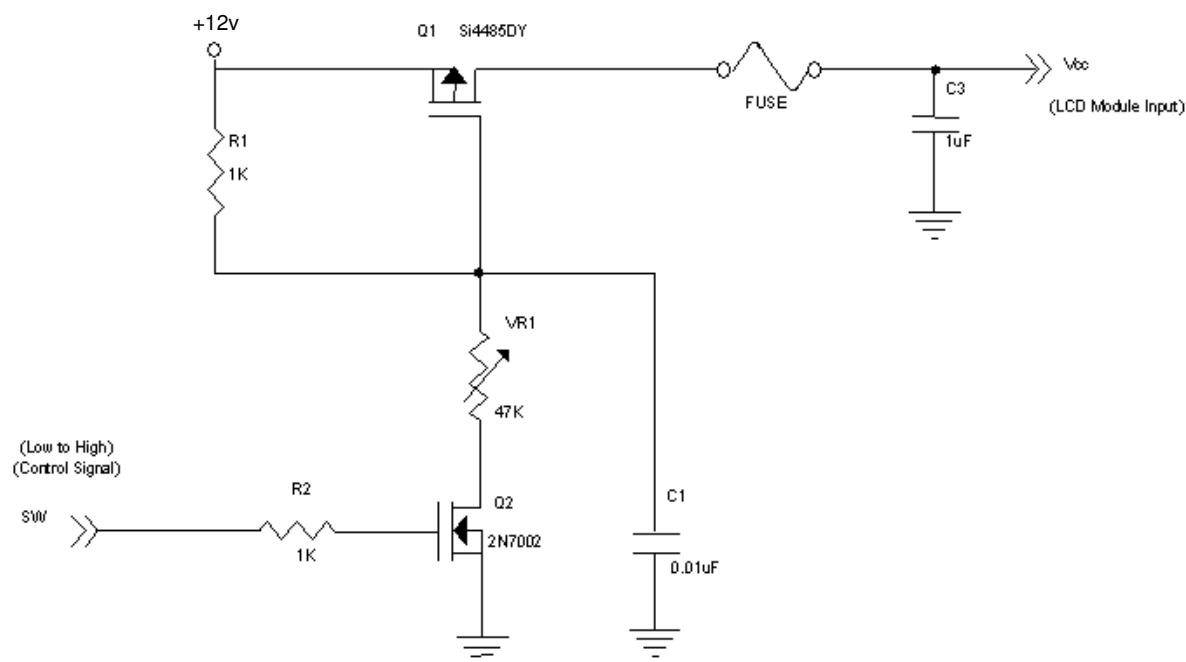
#### 3.1 TFT LCD MODULE

Ta = 25 ± 2 °C

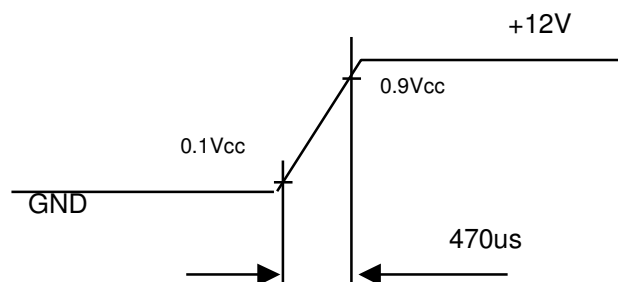
| Parameter                   |                              | Symbol            | Value |      |       | Unit | Note |
|-----------------------------|------------------------------|-------------------|-------|------|-------|------|------|
|                             |                              |                   | Min.  | Typ. | Max.  |      |      |
| Power Supply Voltage        |                              | V <sub>CC</sub>   | 10.8  | 12.0 | 13.2  | V    | (1)  |
| Power Supply Ripple Voltage |                              | V <sub>RP</sub>   | -     | -    | 200   | mV   |      |
| Rush Current                |                              | I <sub>RUSH</sub> | -     | -    | TBD   | A    | (2)  |
| Power Supply Current        | White                        | I <sub>CC</sub>   | -     | TBD  | TBD   | A    | (3)  |
|                             | Black                        |                   | -     | TBD  | -     | A    |      |
|                             | Vertical Stripe              |                   | -     | TBD  | -     | A    |      |
| LVDS Interface              | Common Input Voltage         | V <sub>LVC</sub>  | 1.125 | 1.25 | 1.375 | V    |      |
|                             | Terminating Resistor         | R <sub>T</sub>    | -     | 100  | -     | ohm  |      |
| CMOS interface              | Input High Threshold Voltage | V <sub>IH</sub>   | 2.7   | -    | 3.3   | V    |      |
|                             | Input Low Threshold Voltage  | V <sub>IL</sub>   | 0     | -    | 0.7   | V    |      |

Note (1) The module should be always operated within above ranges.

Note (2) Measurement Conditions:



**Vcc rising time is 470us**



Note (3) The specified power supply current is under the conditions at  $V_{CC} = 12\text{ V}$ ,  $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$ ,  $f_v = 60\text{ Hz}$ , whereas a power dissipation check pattern below is displayed.

a. White Pattern



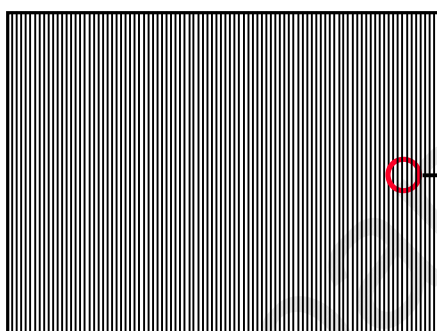
Active Area

b. Black Pattern

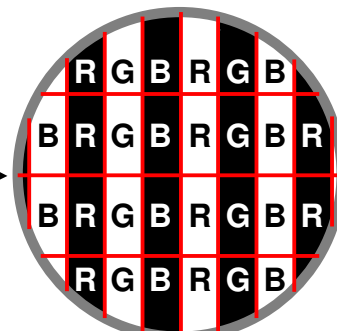


Active Area

c. Vertical Stripe Pattern



Active Area



### 3.2 BACKLIGHT UNIT

#### 3.2.1 CCFL (Cold Cathode Fluorescent Lamp) CHARACTERISTICS ( $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$ )

| Parameter             | Symbol   | Value  |      |      | Unit                     | Note                  |
|-----------------------|----------|--------|------|------|--------------------------|-----------------------|
|                       |          | Min.   | Typ. | Max. |                          |                       |
| Lamp Voltage          | $V_W$    | -      | 940  | -    | Lamp                     | $I_h = 12.0\text{mA}$ |
| Lamp Current          | $I_L$    | 11.7   | 12.0 | 12.3 | $\text{mA}_{\text{RMS}}$ | (1)                   |
| Lamp Starting Voltage | $V_S$    | -      | -    | 1730 | Lamp                     | $V_s$                 |
|                       |          | -      | -    | 1340 |                          |                       |
| Operating Frequency   | $F_O$    | 30     | -    | 80   | Operati                  | $F_O$                 |
| Lamp Life Time        | $L_{BL}$ | 50,000 | -    | -    | Lamp                     | $L_{BL}$              |



Note (1) Lamp current is measured by utilizing AC current probe and its value is average by measuring master and slave board.

Note (2) The lamp starting voltage  $V_S$  should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

Note (3) The lamp frequency may produce interference with horizontal synchronous frequency of the display input signals, and it may result in line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (4) The life time of a lamp is defined as when the brightness is larger than 50% of its original value and the effective discharge length is longer than 80% of its original length (Effective discharge length is defined as an area that has equal to or more than 70% brightness compared to the brightness at the center point of lamp.) as the time in which it continues to operate under the condition at  $T_a = 25 \pm 2^\circ\text{C}$  and  $I_L = 11.5 \sim 12.5\text{mA}$ .

### 3.2.2 INVERTER CHARACTERISTICS ( $T_a = 25 \pm 2^\circ\text{C}$ )

| Parameter             | Symbol    | Value |      |      | Unit              | Note                          |
|-----------------------|-----------|-------|------|------|-------------------|-------------------------------|
|                       |           | Min.  | Typ. | Max. |                   |                               |
| Power Consumption     | $P_{BL}$  | —     | TBD  | —    | W                 | (5) (6) $I_L = 12.0\text{mA}$ |
| Power Supply Voltage  | $V_{BL}$  | 22.8  | 24   | 25.2 | $V_{DC}$          |                               |
| Power Supply Current  | $I_{BL}$  | —     | TBD  | —    | A                 | Non Dimming                   |
| Input Ripple Noise    | —         | —     | —    | 912  | $\text{mV}_{P-P}$ | $V_{BL} = 22.8\text{V}$       |
| Oscillating Frequency | $F_W$     | 37.0  | 40.0 | 43.0 | kHz               | (3)                           |
| Dimming Frequency     | $F_B$     | 150   | 160  | 170  | Hz                |                               |
| Minimum Duty Ratio    | $D_{MIN}$ |       | 20   | —    | %                 |                               |

Note (1) Lamp current is measured by utilizing high frequency current meters as shown below:

Note (2) The lamp starting voltage  $V_S$  should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

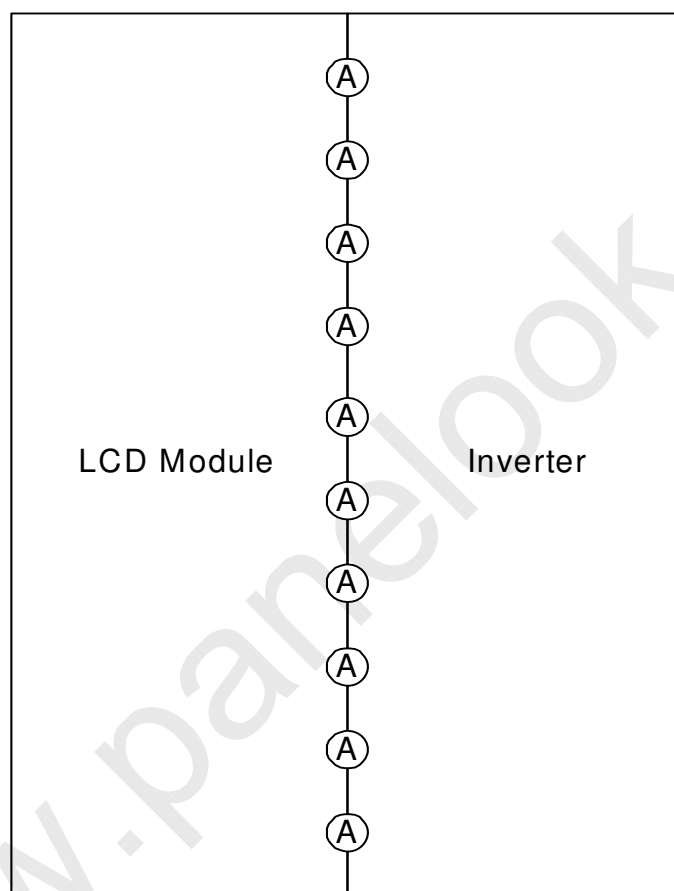
Note (3) The lamp frequency may produce interference with horizontal synchronous frequency of the display input signals, and it may result in line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (4) The life time of a lamp is defined as when the brightness is larger than 50% of its original value and the effective discharge length is longer than 80% of its original length (Effective discharge length is defined as an area that has equal to or more than 70% brightness compared to the brightness at the center point of lamp.) as the time in which it continues to operate under the

condition at  $T_a = 25 \pm 2^\circ\text{C}$  and  $I_L = 11.5 \sim 12.5 \text{ mA rms}$ .

Note (5) The power supply capacity should be higher than the total inverter power consumption  $P_{BL}$ . Since the pulse width modulation (PWM) mode was applied for backlight dimming, the driving current changed as PWM duty on and off. The transient response of power supply should be considered for the changing loading when inverter dimming.

Note (6) The measurement of Max. value is based on 37" backlight unit under 24V input voltage and 12.3 mA lamp in average after lighting for 30 minutes.



**3.2.3 INVERTER INTERFACE CHARACTERISTICS**

| Parameter                    |           | Symbol     | Test Condition | Value |      |      | Unit | Note               |
|------------------------------|-----------|------------|----------------|-------|------|------|------|--------------------|
|                              |           |            |                | Min.  | Typ. | Max. |      |                    |
| On/Off Control Voltage       | ON        | $V_{BLON}$ | —              | 2.0   | —    | 5.0  | V    |                    |
|                              | OFF       |            | —              | 0     | —    | 0.8  | V    |                    |
| Internal PWM Control Voltage | MAX       | $V_{IPWM}$ | —              | 3.15  | 3.3  | 3.45 | V    | Maximum duty ratio |
|                              | MIN       |            |                | —     | 0    | —    | V    | Minimum duty ratio |
| External PWM Control Voltage | HI        | $V_{EPWM}$ | —              | 2.0   | —    | 5.0  | V    | Duty on            |
|                              | LO        |            |                | 0     | —    | 0.8  | V    | Duty off           |
| Status Signal                | HI        | Status     | —              | 3.0   | 3.3  | 3.6  | V    | Normal             |
|                              | LO        |            |                | 0     | —    | 0.8  | V    | Abnormal           |
| VBL Rising Time              |           | $Tr1$      | —              | 30    | —    | —    | ms   | 10%-90% $V_{BL}$   |
| VBL Falling Time             |           | $Tf1$      | —              | 30    | —    | —    | ms   |                    |
| Control Signal Rising Time   |           | $Tr$       | —              | —     | —    | 100  | ms   |                    |
| Control Signal Falling Time  |           | $Tf$       | —              | —     | —    | 100  | ms   |                    |
| PWM Signal Rising Time       |           | $T_{PWMR}$ | —              | —     | —    | 50   | us   |                    |
| PWM Signal Falling Time      |           | $T_{PWMF}$ | —              | —     | —    | 50   | us   |                    |
| Input impedance              |           | $R_{IN}$   | —              | 1     | —    | —    | MΩ   |                    |
| PWM Delay Time               |           | $T_{PWM}$  | —              | 100   | —    | —    | ms   |                    |
| BLON Delay Time              | $T_{on}$  | —          | —              | 300   | —    | —    | ms   |                    |
|                              | $T_{on1}$ | —          | —              | 300   | —    | —    | ms   |                    |
| BLON Off Time                |           | $T_{off}$  | —              | 300   | —    | —    | ms   |                    |

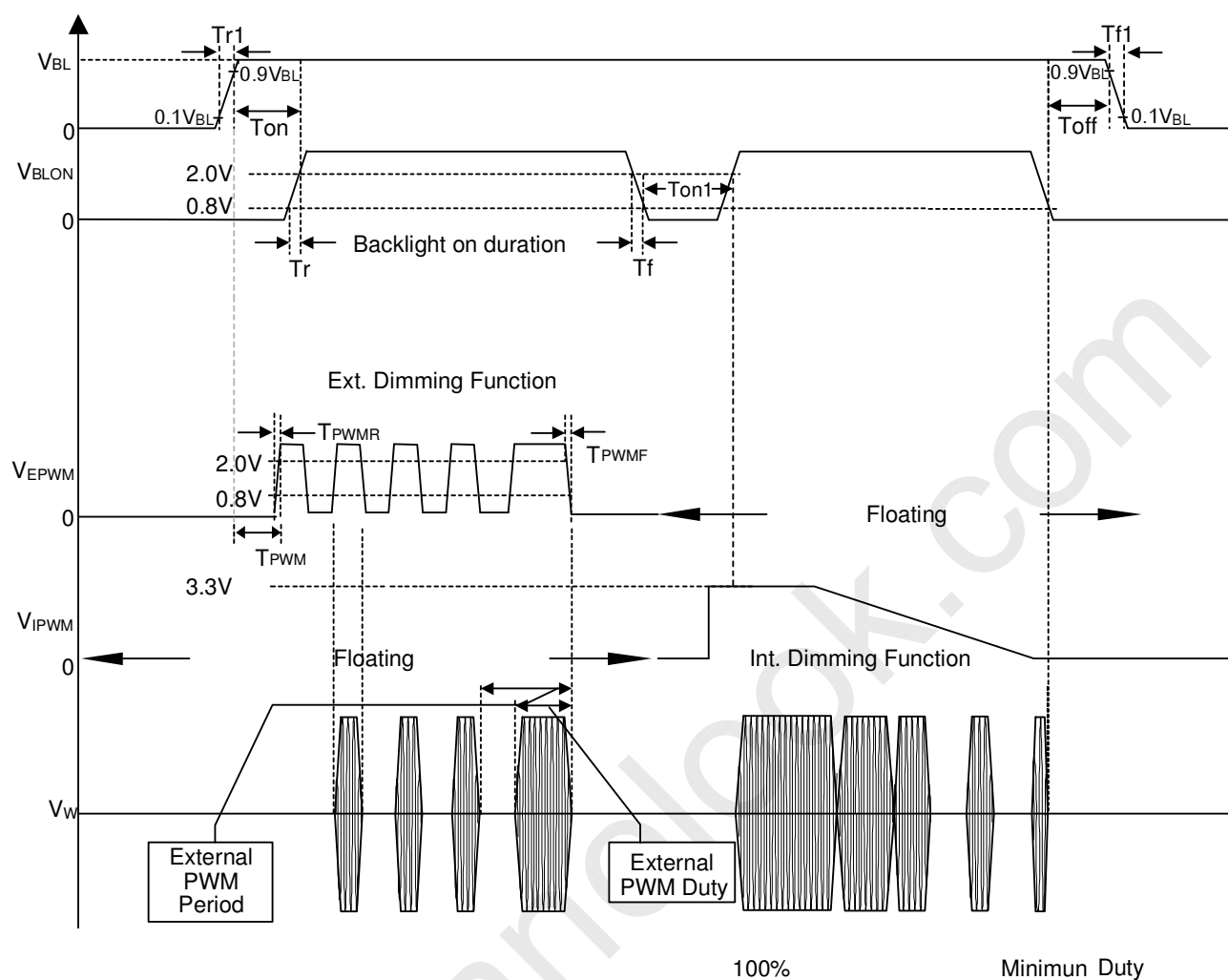
Note (1) The Dimming signal should be valid before backlight turns on by BLON signal. It is inhibited to change the internal/external PWM signal during backlight turn on period.

Note (2) The power sequence and control signal timing are shown in the following figure. For a certain reason, the inverter has a possibility to be damaged with wrong power sequence and control signal timing.

Note (3) While system is turned ON or OFF, the power sequences must follow as below descriptions:

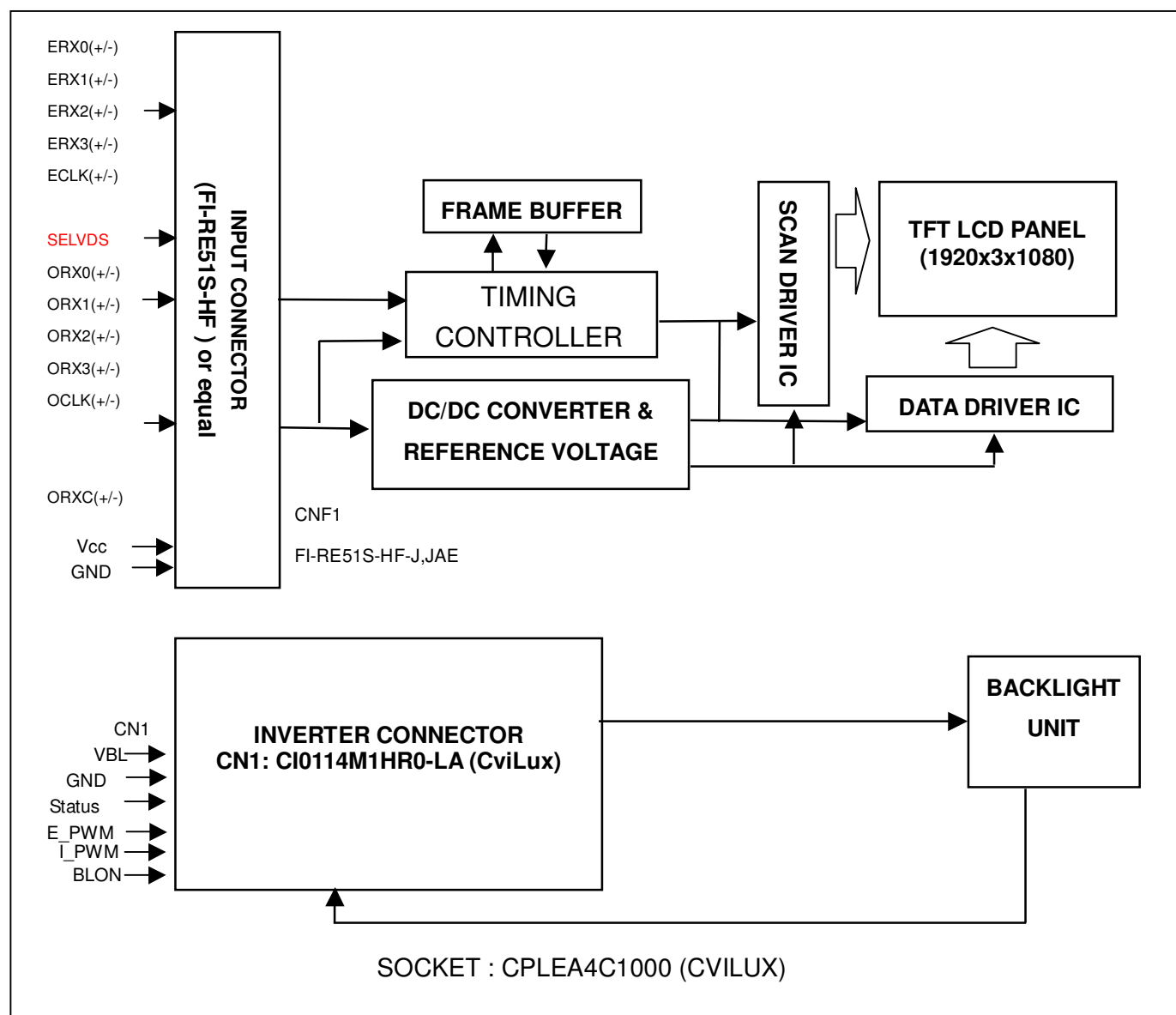
Turn ON sequence: VBL → PWM signal → BLON

Turn OFF sequence: BLOFF → PWM signal → VBL



## 4. BLOCK DIAGRAM

### 4.1 TFT LCD MODULE





## 5. INTERFACE PIN CONNECTION

### 5.1 TFT LCD MODULE

#### CNF1 Connector Pin Assignment

| Pin | Name    | Description                                                | Note   |
|-----|---------|------------------------------------------------------------|--------|
| 1   | N.C.    | No Connection                                              | (2)    |
| 2   | N.C.    | No Connection                                              |        |
| 3   | N.C.    | No Connection                                              |        |
| 4   | N.C.    | No Connection                                              |        |
| 5   | N.C.    | No Connection                                              |        |
| 6   | N.C.    | No Connection                                              |        |
| 7   | SELLVDS | LVDS data format Selection                                 | (3)(6) |
| 8   | N.C.    | No Connection                                              | (2)    |
| 9   | ODSEL   | Overdrive Lookup Table Selection                           | (4)(6) |
| 10  | N.C.    | No Connection                                              | (2)    |
| 11  | EN_DBL  | Enable Dynamic Backlight                                   | (5)(6) |
| 12  | ORX0-   | 2nd pixel Negative LVDS differential data input. Channel 0 |        |
| 13  | ORX0+   | 2nd pixel Positive LVDS differential data input. Channel 0 |        |
| 14  | ORX1-   | 2nd pixel Negative LVDS differential data input. Channel 1 |        |
| 15  | ORX1+   | 2nd pixel Positive LVDS differential data input. Channel 1 |        |
| 16  | ORX2-   | 2nd pixel Negative LVDS differential data input. Channel 2 |        |
| 17  | ORX2+   | 2nd pixel Positive LVDS differential data input. Channel 2 |        |
| 18  | GND     | Ground                                                     |        |
| 19  | OCLK-   | 2nd pixel Negative LVDS differential clock input.          |        |
| 20  | OCLK+   | 2nd pixel Positive LVDS differential clock input.          |        |
| 21  | GND     | Ground                                                     |        |
| 22  | ORX3-   | 2nd pixel Negative LVDS differential data input. Channel 3 |        |
| 23  | ORX3+   | 2nd pixel Positive LVDS differential data input. Channel 3 |        |
| 24  | N.C.    | No Connection                                              | (2)    |
| 25  | N.C.    | No Connection                                              | (2)    |
| 26  | N.C.    | No Connection                                              | (2)    |
| 27  | N.C.    | No Connection                                              | (2)    |
| 28  | ERX0-   | 1st pixel Negative LVDS differential data input. Channel 0 |        |
| 29  | ERX0+   | 1st pixel Positive LVDS differential data input. Channel 0 |        |
| 30  | ERX1-   | 1st pixel Negative LVDS differential data input. Channel 1 |        |
| 31  | ERX1+   | 1st pixel Positive LVDS differential data input. Channel 1 |        |
| 32  | ERX2-   | 1st pixel Negative LVDS differential data input. Channel 2 |        |
| 33  | ERX2+   | 1st pixel Positive LVDS differential data input. Channel 2 |        |



|    |       |                                                            |     |
|----|-------|------------------------------------------------------------|-----|
| 34 | GND   | Ground                                                     |     |
| 35 | ECLK- | 1st pixel Negative LVDS differential clock input.          |     |
| 36 | ECLK+ | 1st pixel Positive LVDS differential clock input.          |     |
| 37 | GND   | Ground                                                     |     |
| 38 | ERX3- | 1st pixel Negative LVDS differential data input. Channel 3 |     |
| 39 | ERX3+ | 1st pixel Positive LVDS differential data input. Channel 3 |     |
| 40 | N.C.  | No Connection                                              | (2) |
| 41 | N.C.  | No Connection                                              | (2) |
| 42 | N.C.  | No Connection                                              | (2) |
| 43 | N.C.  | No Connection                                              | (2) |
| 44 | GND   | Ground                                                     |     |
| 45 | GND   | Ground                                                     |     |
| 46 | GND   | Ground                                                     |     |
| 47 | GND   | Ground                                                     |     |
| 48 | VCC   | Power input (+12V)                                         |     |
| 49 | VCC   | Power input (+12V)                                         |     |
| 50 | VCC   | Power input (+12V)                                         |     |
| 51 | VCC   | Power input (+12V)                                         |     |

Note (1) Connector part no.: FI-RE51S-HF(JAE) or equivalent

Note (2) Please be reserved to open.

Note (3) Low : VESA LVDS Format (default), High : JEIDA LVDS Format.

Note (4) Overdrive lookup table selection. The overdrive lookup table should be selected in accordance to the frame rate to optimize image quality.

| ODSEL   | Note                                             |
|---------|--------------------------------------------------|
| L or NC | Lookup table was optimized for 60 Hz frame rate. |
| H       | Lookup table was optimized for 50 Hz frame rate. |

Note (5) Low : disable dynamic backlight (default), High : enable dynamic backlight function

Note (6) Low = Open or connect to GND, High = Connect to +3.3V

## 5.2 BACKLIGHT UNIT

The pin configuration for the housing and leader wire is shown in the table below.

| Pin No. | Symbol | Description | Remark |
|---------|--------|-------------|--------|
| NA      | NA     | NA          | NA     |

Note (1) The backlight interface housing for high voltage side is a model CPLEA4C1000, manufactured by CVILUX or equivalent.







### 5.3 INVERTER UNIT

CN1 (Header): CI0114M1HR0-LA (CviLux)

| Pin No. | Symbol | Description                    |
|---------|--------|--------------------------------|
| 1       | VBL    | +24V Power input               |
| 2       |        |                                |
| 3       |        |                                |
| 4       |        |                                |
| 5       |        |                                |
| 6       | GND    | Ground                         |
| 7       |        |                                |
| 8       |        |                                |
| 9       |        |                                |
| 10      |        |                                |
| 11      | Status | Normal (3.3V)<br>Abnormal (0V) |
| 12      | E_PWM  | External PWM Control           |
| 13      | I_PWM  | Internal PWM Control           |
| 14      | BLON   | BL ON/OFF                      |

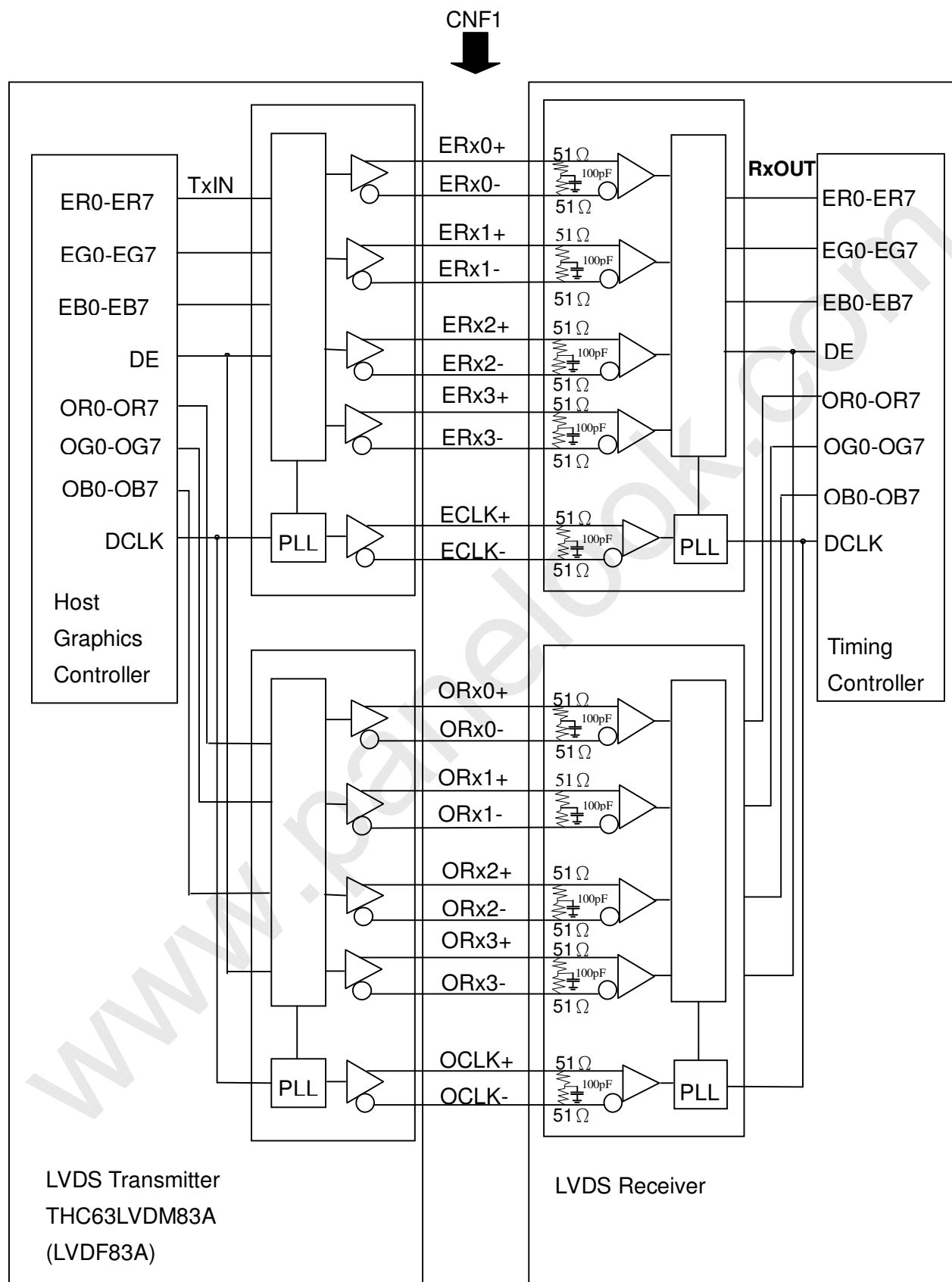
Notice:

PIN 13:Internal PWM Control (Use Pin 13): Pin 12 must open.

PIN 12:External PWM Control (Use Pin 12): Pin 13 must open.

Pin 13(I\_PWM) and Pin 12(E\_PWM) can't open in same period.

## 5.4 BLOCK DIAGRAM OF INTERFACE



ER0~ER7: First pixel R data

EG0~EG7: First pixel G data

EB0~EB7: First pixel B data

OR0~OR7: Second pixel R data

OG0~OG7: Second pixel G data

OB0~OB7: Second pixel B data

DE: Data enable signal

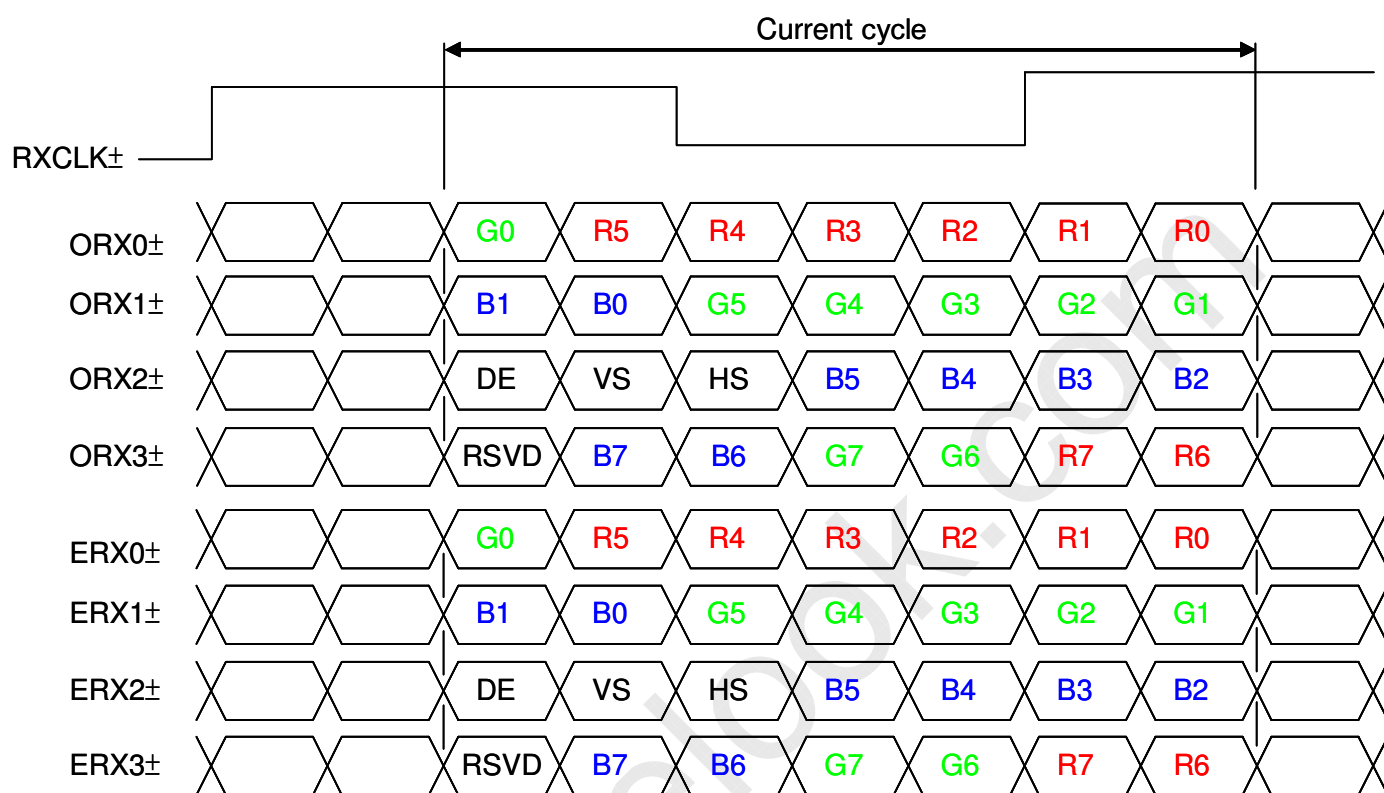
DCLK: Data clock signal

Notes:

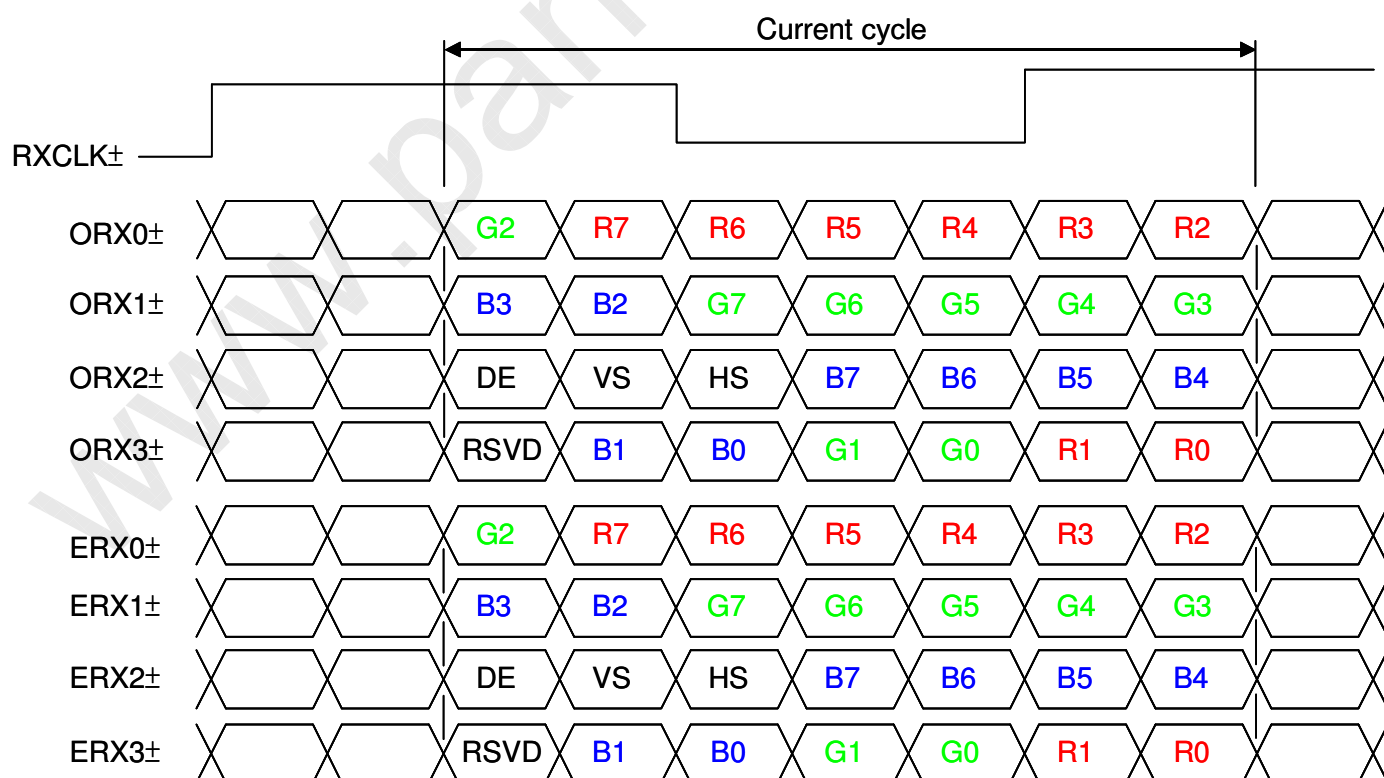
- (1) The system must have the transmitter to drive the module.
- (2) LVDS cable impedance shall be 50 ohms per signal line or about 100 ohms per twist-pair line when it is used differentially.
- (3) Two pixel data send into the module for every clock cycle. The first pixel of the frame is even pixel and the second pixel is odd pixel.

## 5.5 LVDS INTERFACE

VESA LVDS format : (SELLVDS pin=L or OPEN)



JEDIA LVDS format : (SELLVDS pin=H)





R0~R7: Pixel R Data (7; MSB, 0; LSB)

G0~G7: Pixel G Data (7; MSB, 0; LSB)

B0~B7: Pixel B Data (7; MSB, 0; LSB)

DE : Data enable signal

DCLK : Data clock signal

Notes (1) RSVD (reserved) pins on the transmitter shall be "H" or "L"

## 5.6 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

| Color               |                 | Data Signal |    |    |    |    |    |    |    |       |    |    |    |    |    |    |    |      |    |    |    |    |    |   |   |   |   |   |  |
|---------------------|-----------------|-------------|----|----|----|----|----|----|----|-------|----|----|----|----|----|----|----|------|----|----|----|----|----|---|---|---|---|---|--|
|                     |                 | Red         |    |    |    |    |    |    |    | Green |    |    |    |    |    |    |    | Blue |    |    |    |    |    |   |   |   |   |   |  |
|                     |                 |             |    |    |    |    |    |    |    |       |    |    |    |    |    |    |    |      |    |    |    |    |    |   |   |   |   |   |  |
| R7                  | R6              | R5          | R4 | R3 | R2 | R1 | R0 | G7 | G6 | G5    | G4 | G3 | G2 | G1 | G0 | B7 | B6 | B5   | B4 | B3 | B2 | B1 | B0 |   |   |   |   |   |  |
| Basic Colors        | Black           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |  |
|                     | Red             | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |  |
|                     | Green           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |  |
|                     | Blue            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1 | 1 | 1 | 1 | 1 |  |
|                     | Cyan            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1 | 1 | 1 | 1 | 1 |  |
|                     | Magenta         | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1 | 1 | 1 | 1 | 1 |  |
|                     | Yellow          | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |  |
|                     | White           | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1 | 1 | 1 | 1 | 1 |  |
| Gray Scale Of Red   | Red(0) / Dark   | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |  |
|                     | Red(1)          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |  |
|                     | Red(2)          | 0           | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |  |
|                     | :               | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | : | : | : | : | : |  |
|                     | :               | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | : | : | : | : | : |  |
|                     | Red(253)        | 1           | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |  |
|                     | Red(254)        | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |  |
|                     | Red(255)        | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |  |
| Gray Scale Of Green | Green(0) / Dark | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |  |
|                     | Green(1)        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |  |
|                     | Green(2)        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |  |
|                     | :               | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | : | : | : | : | : |  |
|                     | :               | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | : | : | : | : | : |  |
|                     | Green(253)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |  |
|                     | Green(254)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |  |
|                     | Green(255)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |  |
| Gray Scale Of Blue  | Blue(0) / Dark  | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |  |
|                     | Blue(1)         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 1 | 0 |  |
|                     | Blue(2)         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 1 | 0 | 0 |  |
|                     | :               | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | : | : | : | : | : |  |
|                     | :               | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | : | : | : | : | : |  |
|                     | Blue(253)       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1 | 0 | 1 | 0 | 0 |  |
|                     | Blue(254)       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1 | 1 | 1 | 0 | 0 |  |
|                     | Blue(255)       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1 | 1 | 1 | 1 | 0 |  |

Note (1) 0: Low Level Voltage, 1: High Level Voltage

## 6. INTERFACE TIMING

### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

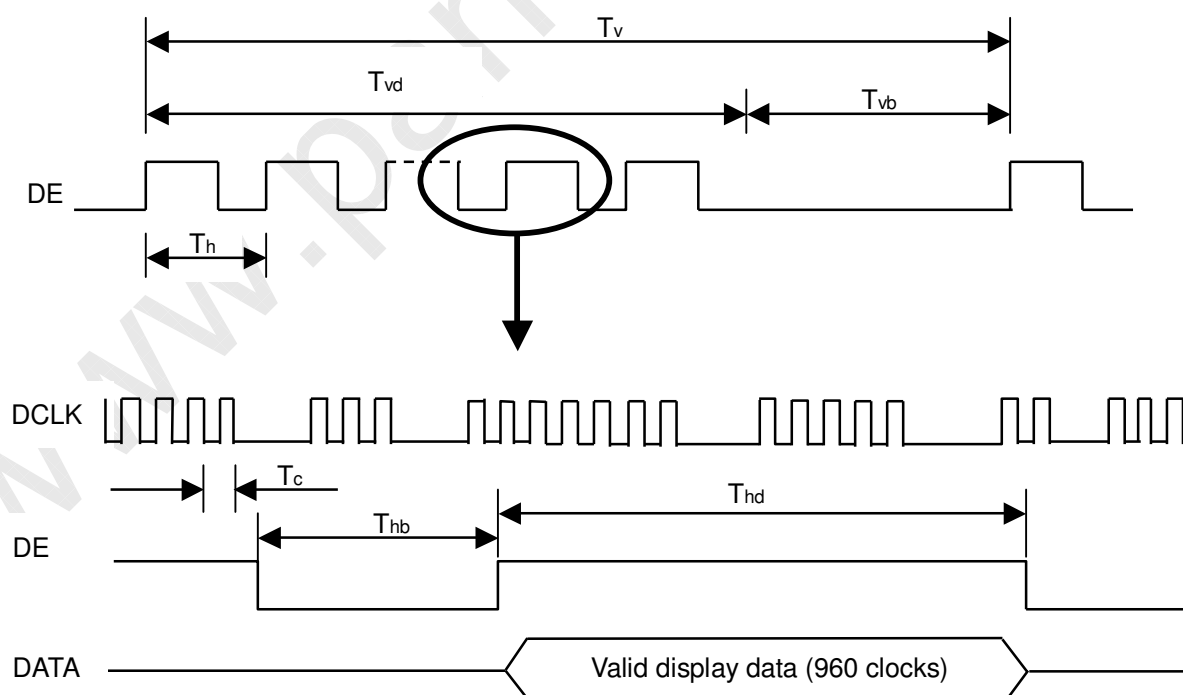
The input signal timing specifications are shown as the following table and timing diagram.

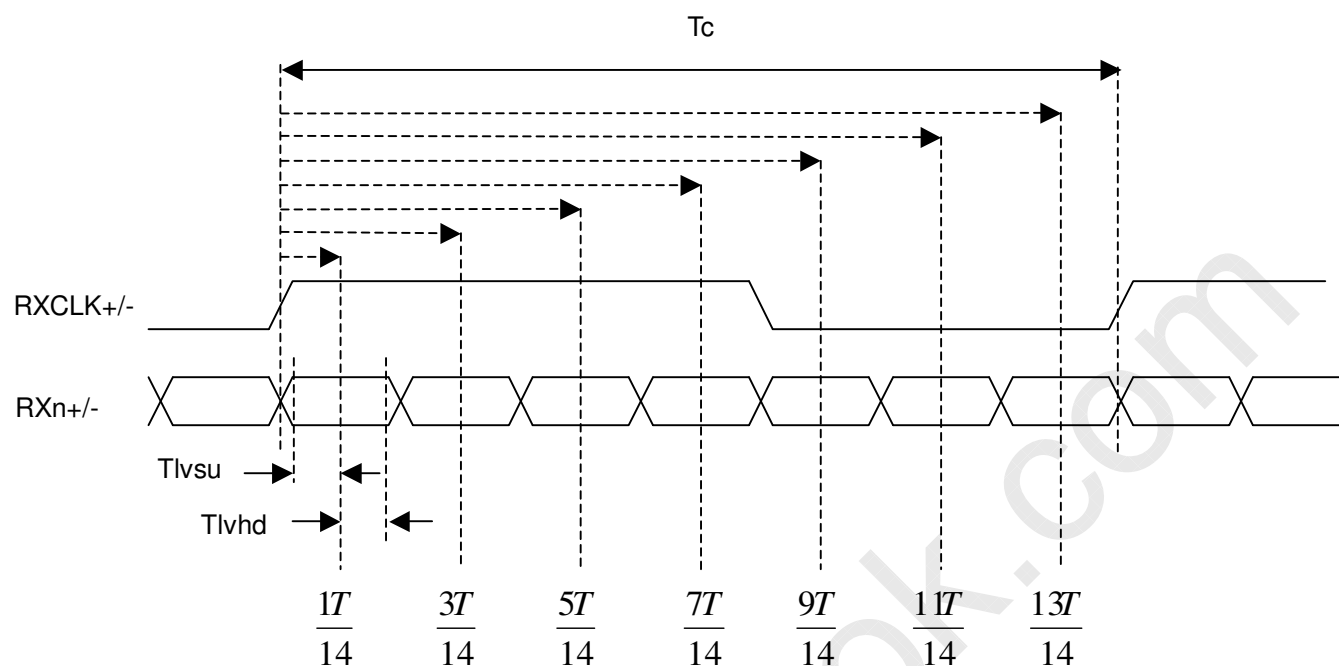
| Signal                         | Item                        | Symbol | Min. | Typ. | Max. | Unit | Note       |
|--------------------------------|-----------------------------|--------|------|------|------|------|------------|
| LVDS Receiver Clock            | Frequency                   | 1/Tc   | 60   | 74   | 80   | MHz  |            |
|                                | Input cycle to cycle jitter | Trcl   | -    | -    | 200  | ps   |            |
| LVDS Receiver Data             | Setup Time                  | Tlvsu  | 600  | -    | -    | ps   |            |
|                                | Hold Time                   | Tlvhd  | 600  | -    | -    | ps   |            |
| Vertical Active Display Term   | Frame Rate                  | Fr5    | 47   | 50   | 53   | Hz   | (1)        |
|                                |                             | Fr6    | 57   | 60   | 63   | Hz   | (2)        |
|                                | Total                       | Tv     | 1115 | 1125 | 1135 | Th   | Tv=Tvd+Tvb |
|                                | Display                     | Tvd    | 1080 | 1080 | 1080 | Th   | -          |
|                                | Blank                       | Tvb    | 35   | 45   | 55   | Th   | -          |
| Horizontal Active Display Term | Total                       | Th     | 1050 | 1100 | 1150 | Tc   | Th=Thd+Thb |
|                                | Display                     | Thd    | 960  | 960  | 960  | Tc   | -          |
|                                | Blank                       | Thb    | 90   | 140  | 190  | Tc   | -          |

Note (1) (ODSEL) = (H). Please refer to 5.1 for detail information.

(2) (ODSEL) = (L). Please refer to 5.1 for detail information.

### INPUT SIGNAL TIMING DIAGRAM

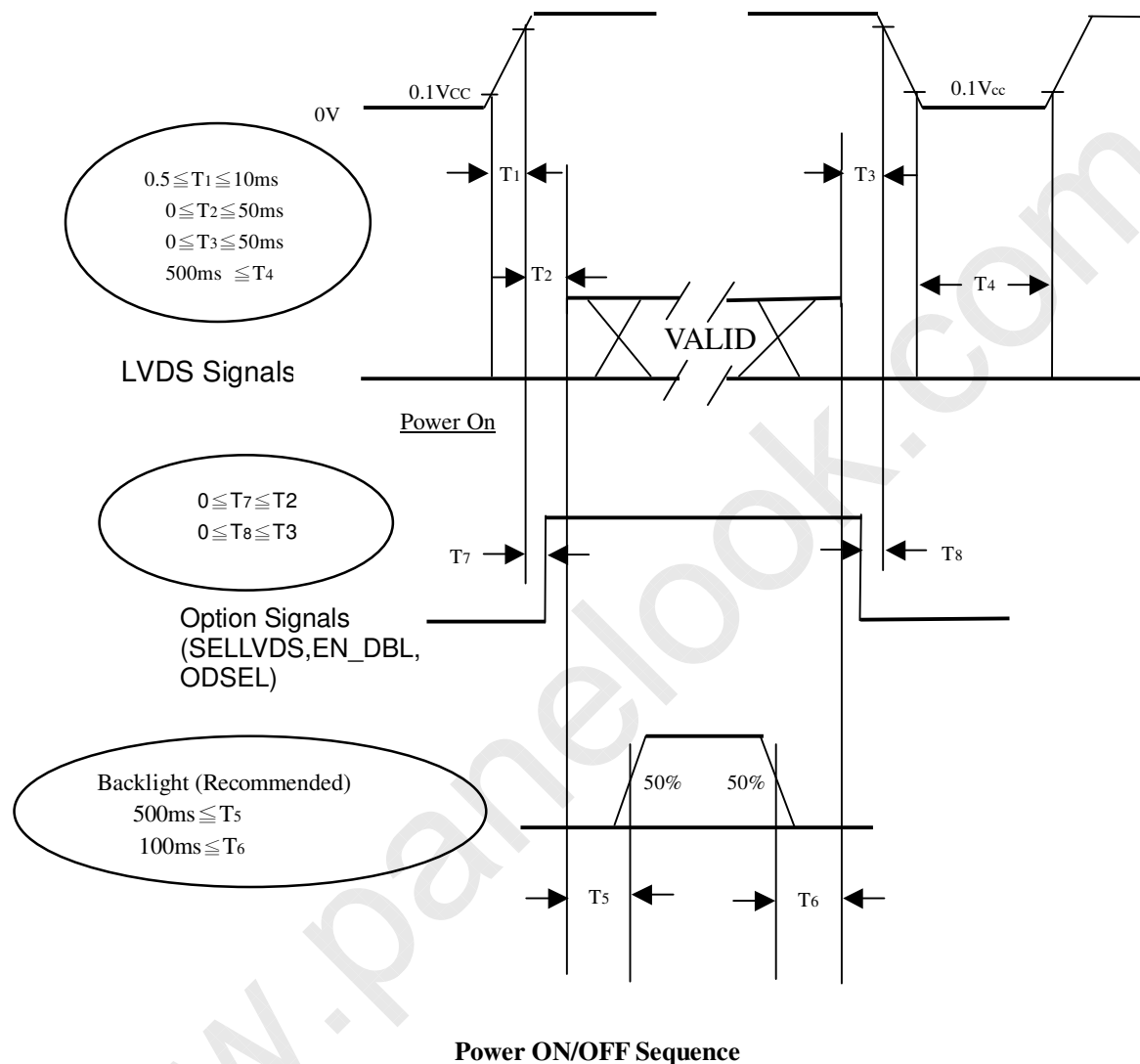


**LVDS RECEIVER INTERFACE TIMING DIAGRAM**



## 6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below.



Note (1) The supply voltage of the external system for the module input should follow the definition of Vcc.

Note (2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.

Note (3) In case of Vcc is in off level, please keep the level of input signals on the low or high impedance.

Note (4) T4 should be measured after the module has been fully discharged between power off and on period.

Note (5) Interface signal shall not be kept at high impedance when the power is on.

## 7. OPTICAL CHARACTERISTICS

### 7.1 TEST CONDITIONS

| Item                                     | Symbol                                                        | Value      | Unit |
|------------------------------------------|---------------------------------------------------------------|------------|------|
| Ambient Temperature                      | Ta                                                            | 25±2       | °C   |
| Ambient Humidity                         | Ha                                                            | 50±10      | %RH  |
| Supply Voltage                           | V <sub>CC</sub>                                               | 12         | V    |
| Input Signal                             | According to typical value in "3. ELECTRICAL CHARACTERISTICS" |            |      |
| Lamp Current(HV)                         | I <sub>L</sub>                                                | 12.0 ± 0.5 | mA   |
| Oscillating Frequency<br>(Balance Board) | F <sub>w</sub>                                                | 63±3       | KHz  |
| Frame rate                               |                                                               | 60         | Hz   |

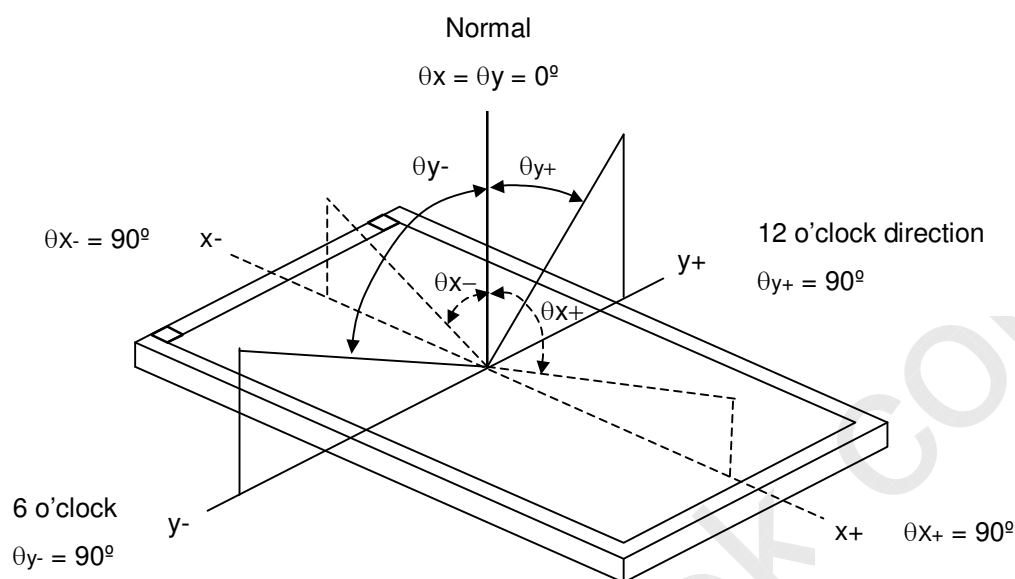
### 7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

| Item                      |             | Symbol                  | Condition                                                                    | Min.           | Typ.  | Max.           | Unit | Note |
|---------------------------|-------------|-------------------------|------------------------------------------------------------------------------|----------------|-------|----------------|------|------|
| Contrast Ratio            |             | CR                      | $\theta_x=0^\circ, \theta_y=0^\circ$<br>Viewing angle at<br>Normal direction | 4000           | 5000  | -              | -    | (2)  |
| Response Time             |             | Gray to gray<br>average |                                                                              | -              | 6.5   | 12             | ms   | (3)  |
| Center Luminance of White |             | L <sub>c</sub>          |                                                                              | (TBD)          | 450   | -              | cd/  | (4)  |
| White Variation           |             | $\delta W$              |                                                                              | -              | -     | 1.3            | -    | (7)  |
| Cross Talk                |             | CT                      |                                                                              | -              | -     | 4.0            | %    | (5)  |
| Color<br>Chromaticity     | Red         | R <sub>x</sub>          |                                                                              | Typ. -<br>0.03 | (TBD) | Typ. +<br>0.03 | -    | (6)  |
|                           |             | R <sub>y</sub>          |                                                                              |                | (TBD) |                | -    |      |
|                           | Green       | G <sub>x</sub>          |                                                                              |                | (TBD) |                | -    |      |
|                           |             | G <sub>y</sub>          |                                                                              |                | (TBD) |                | -    |      |
|                           | Blue        | B <sub>x</sub>          |                                                                              |                | (TBD) |                | -    |      |
|                           |             | B <sub>y</sub>          |                                                                              |                | (TBD) |                | -    |      |
|                           | White       | W <sub>x</sub>          |                                                                              |                | 0.280 |                | -    |      |
|                           |             | W <sub>y</sub>          |                                                                              |                | 0.290 |                | -    |      |
|                           | Color Gamut | CG                      |                                                                              | 70             | 72    |                | %    | NTSC |
| Viewing<br>Angle          | Horizontal  | $\theta_{x+}$           | CR≥20                                                                        | 80             | 88    | -              | Deg  | (1)  |
|                           |             | $\theta_{x-}$           |                                                                              | 80             | 88    | -              |      |      |
|                           | Vertical    | $\theta_{y+}$           |                                                                              | 80             | 88    | -              |      |      |
|                           |             | $\theta_{y-}$           |                                                                              | 80             | 88    | -              |      |      |
|                           |             |                         |                                                                              | 80             | 88    | -              |      |      |

Note (1) Definition of Viewing Angle ( $\theta_x$ ,  $\theta_y$ ):

Viewing angles are measured by EZ-Contrast 160R (Eldim)



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

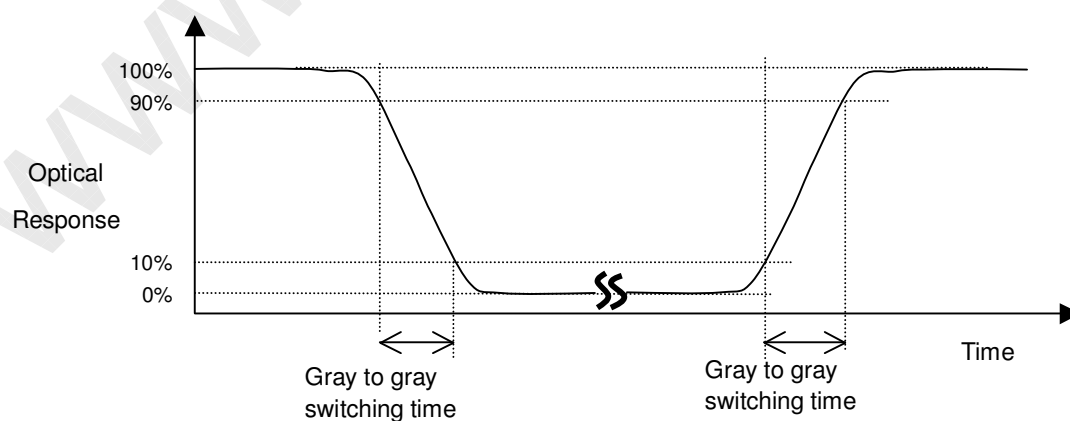
$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (5), where CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (7).

Note (3) Definition of Gray to Gray Switching Time :



The driving signal means the signal of gray level 0, 63, 127, 191, 255.

Gray to gray average time means the average switching time of gray level 0, 63, 127, 191, 255 to each other.

Note (4) Definition of Luminance of White ( $L_C$ ,  $L_{AVE}$ ):

Measure the luminance of gray level 255 at center point and 5 points

$$L_C = L(5)$$

$$L_{AVE} = [L(1) + L(2) + L(3) + L(4) + L(5)] / 5$$

where  $L(x)$  is corresponding to the luminance of the point  $x$  at the figure in Note (7).

Note (5) Definition of Cross Talk (CT):

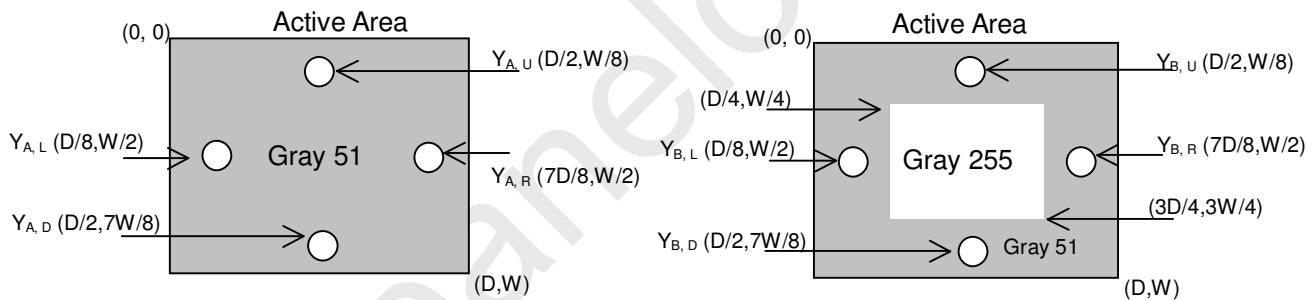
$$CT = |Y_B - Y_A| / Y_A \times 100 (\%)$$

Where:

(a)

$Y_A$  = Luminance of measured location without gray level 255 pattern ( $\text{cd/m}^2$ )

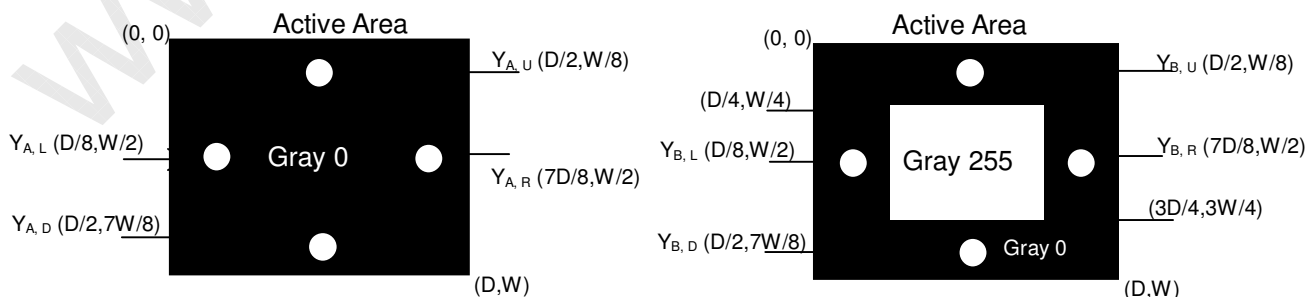
$Y_B$  = Luminance of measured location with gray level 255 pattern ( $\text{cd/m}^2$ )



(b)

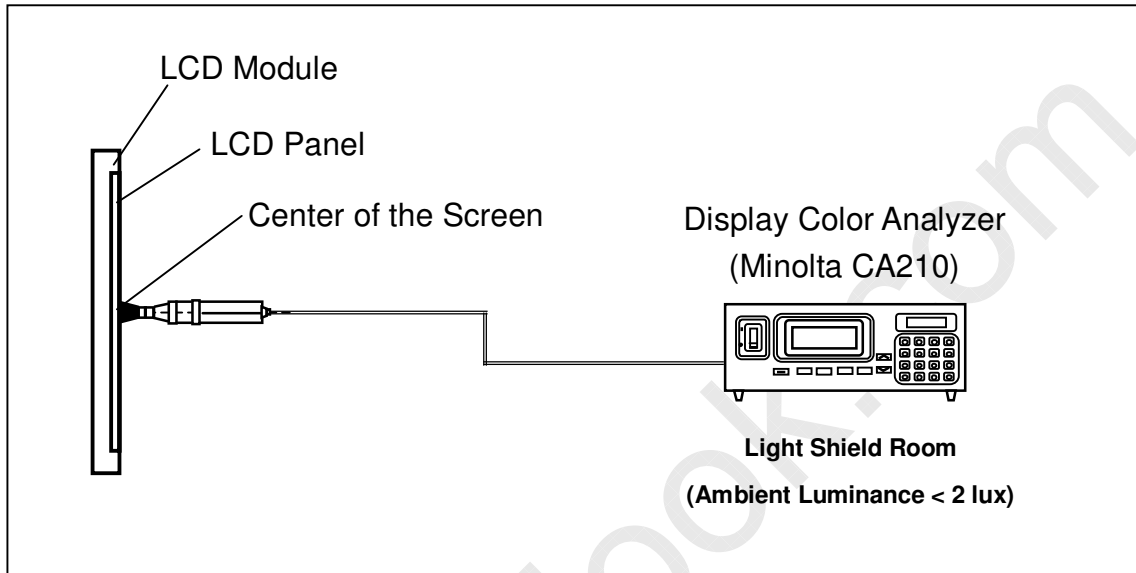
$Y_A$  = Luminance of measured location without gray level 255 pattern ( $\text{cd/m}^2$ )

$Y_B$  = Luminance of measured location with gray level 255 pattern ( $\text{cd/m}^2$ )



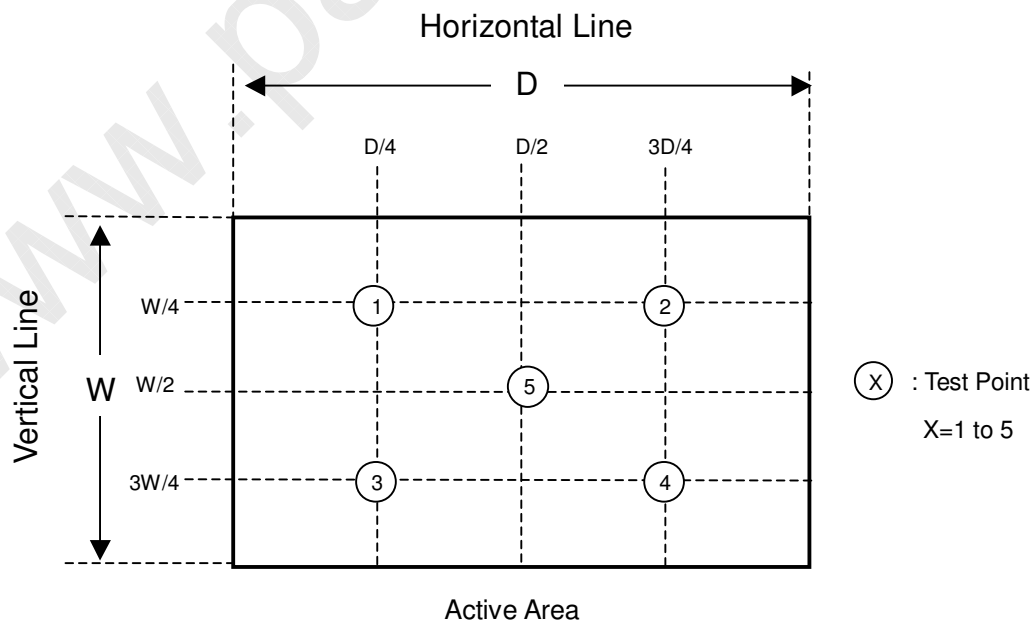
**Note (6) Measurement Setup:**

The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 1 hour in a windless room.

**Note (7) Definition of White Variation ( $\delta W$ ):**

Measure the luminance of gray level 255 at 5 points

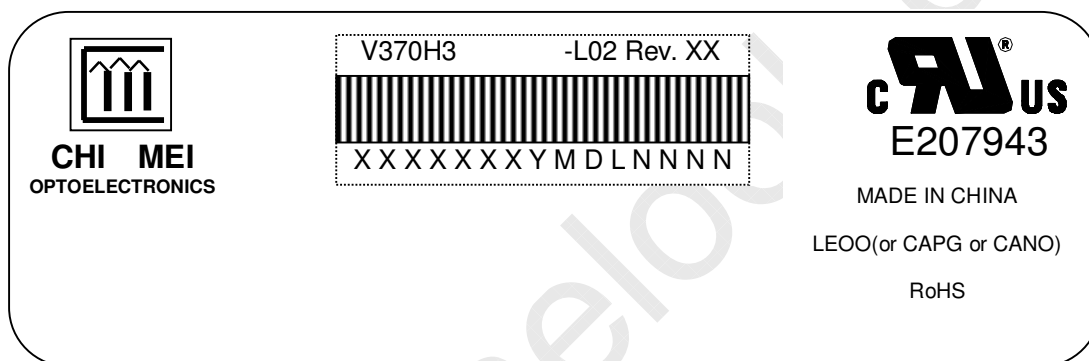
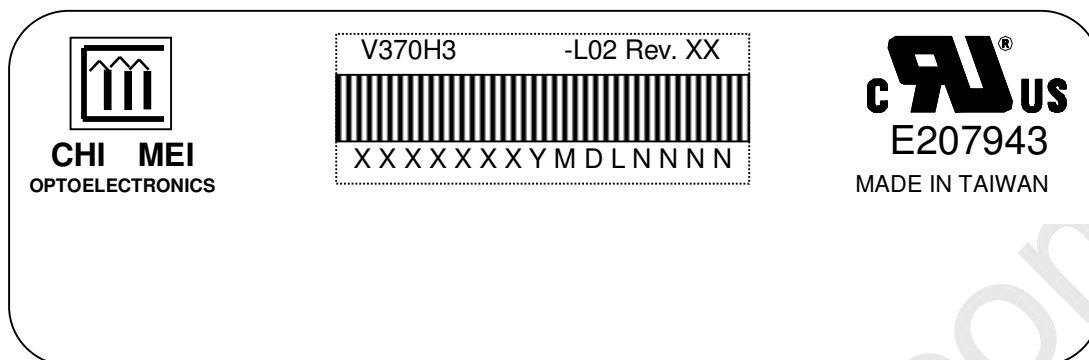
$$\delta W = \text{Maximum} [L(1), L(2), L(3), L(4), L(5)] / \text{Minimum} [L(1), L(2), L(3), L(4), L(5)]$$



## 8. DEFINITION OF LABELS

### 8.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



(a) Model Name: V370H3-L02

(b) Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.

(c) CMO barcode definition:

Serial ID: XX-XX-X-XX-YMD-L-NNNN

| Code | Meaning          | Description                                                                                                                                                                               |
|------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| XX   | CMO internal use | -                                                                                                                                                                                         |
| XX   | Revision         | Cover all the change                                                                                                                                                                      |
| X-XX | CMO internal use | -                                                                                                                                                                                         |
| YMD  | Year, month, day | Year: 2001=1, 2002=2, 2003=3, 2004=4...<br>Month: Jan. ~ Dec.=1, 2, 3, ~, 9, A, B, C<br>Day: 1 <sup>st</sup> to 31 <sup>st</sup> =1, 2, 3, ~, 9, A, B, C, ~, W, X, Y, exclude I, O, and U |
| L    | Product line #   | Line 1=1, Line 2=2, Line 3=3, ...                                                                                                                                                         |
| NNNN | Serial number    | Manufacturing sequence of product                                                                                                                                                         |

## 9. PACKAGING

### 9.1 PACKING SPECIFICATIONS

- (1) 5 LCD TV modules / 1 Box
- (2) Box dimensions : 954(L)x378(W)x602(H)mm
- (3) Weight : approximately 42.5 Kg ( 5 modules per box)

### 9.2 PACKING METHOD

Figures 10-1 and 10-2 are the packing method

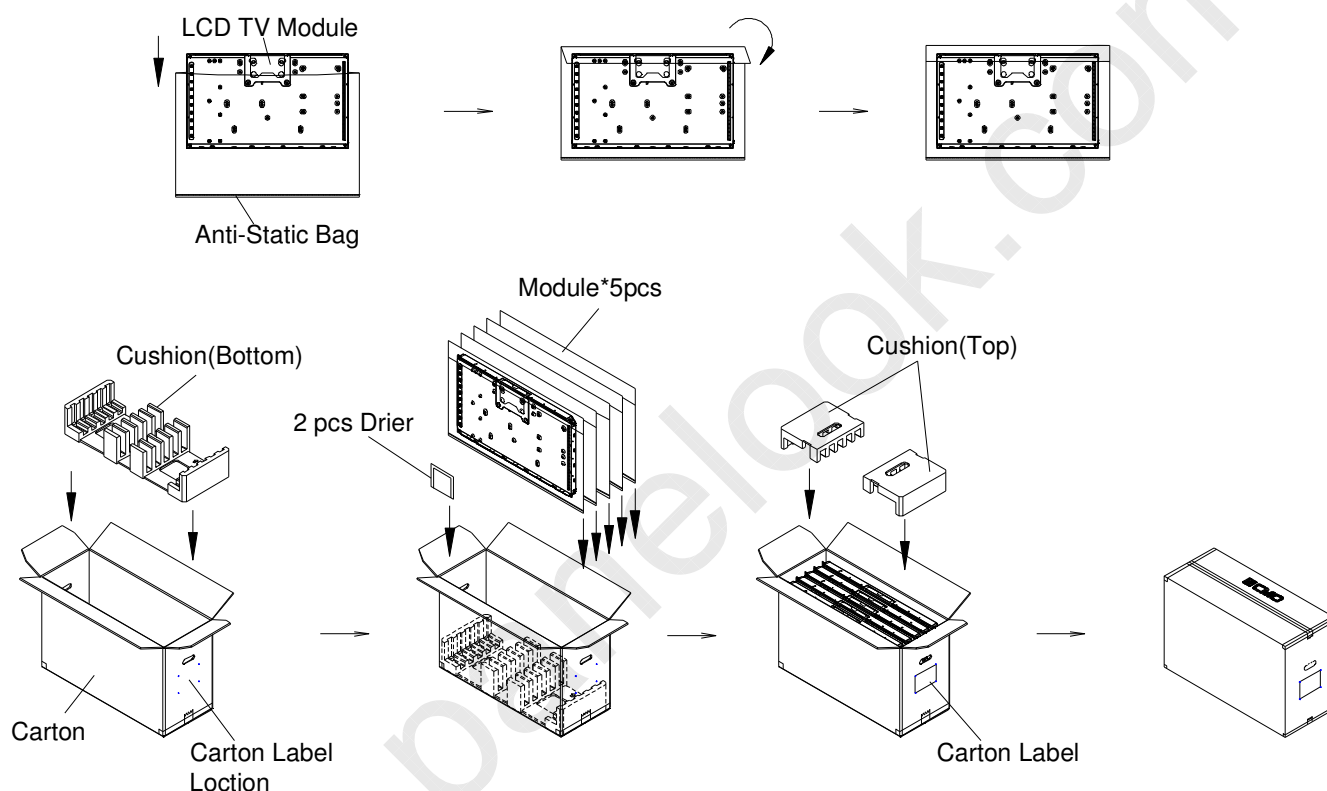
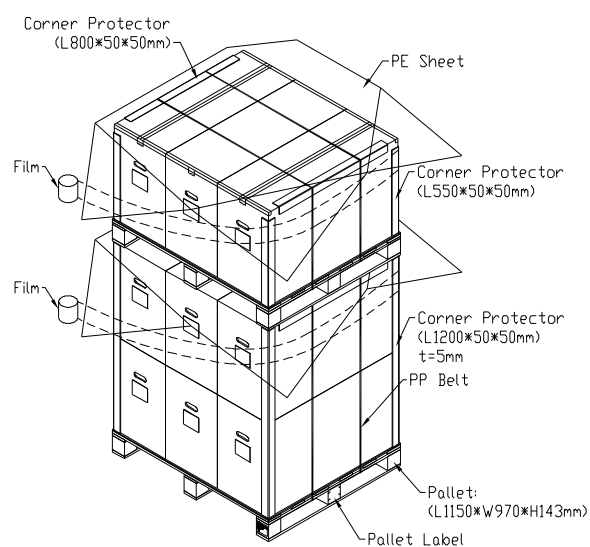


Figure.9-1 packing method

### Sea / Land Transportation (40ft Container)



### Air Transportation

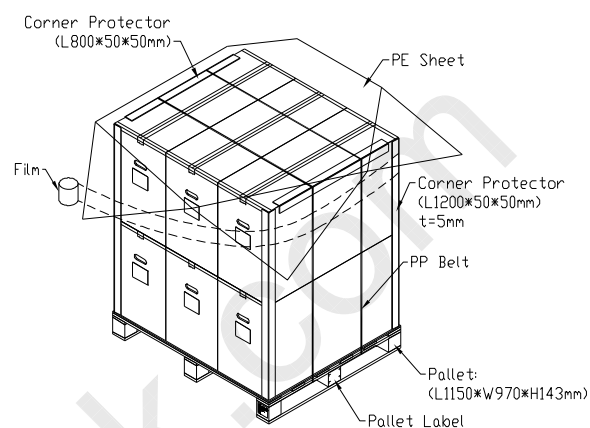


Figure.9-2 Packing method



## 10. PRECAUTIONS

### 10.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) It is recommended to assemble or to install a module into the user's system in clean working areas.  
The dust and oil may cause electrical short or worsen the polarizer.
- (3) Do not apply pressure or impulse to the module to prevent the damage of LCD panel and backlight.
- (4) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.
- (5) Do not plug in or pull out the I/F connector while the module is in operation.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) Moisture can easily penetrate into LCD module and may cause the damage during operation.
- (9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD modules in the specified storage conditions.
- (10) When ambient temperature is lower than 10°C, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of CCFL will be higher than that of room temperature.

### 10.2 SAFETY PRECAUTIONS

- (1) The startup voltage of a backlight is over 1000 Volts. It may cause an electrical shock while assembling with the inverter. Do not disassemble the module or insert anything into the backlight unit.
- (2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (3) After the module's end of life, it is not harmful in case of normal operation and storage.

### 10.3 SAFETY STANDARDS

The LCD module should be certified with safety regulations as follows:

- (1) UL60950-1 or updated standard.
- (2) IEC60950-1 or updated standard.
- (3) UL60065 or updated standard.
- (4) IEC60065 or updated standard.



